POWERS AND POLYNOMIALS (3.1)

1. Find the indicated derivative.

A. $\frac{dy}{dt}$ for $y = \frac{1}{\sqrt[3]{t^2}} - t + 4$

B. $\frac{d^2x}{dt^2}$ for $x(t) = 5t^4 - 3t^{\pi} + \pi^7$

C. $f'(x)$ for $f(x) = \frac{ax^2 + bx + c}{dx}$

D. $g'(z)$ for $g(z) = \left(\sqrt{z} + 1\right)^2$

2. Suppose g and k are differentiable functions with the values $g'(3) = -2$, $k'(3) = 12$, $g(3) = 4$, and $k(3) = -5$. Let $h(x) = 5g(x) - k(x) + 7x^2 - g(3)$.

A. Find $h'(3)$.
B. Find an equation of the tangent line to $h(x)$ at $x = 3$.
C. Use part B. to estimate the $h(3.5)$.

3. Find all values of t so that $f(t) = t^4 - 6t^2 + 12$ has a horizontal tangent.

EXPONENTIAL FUNCTIONS (3.2)

1. Find the indicated derivative.

A. $\frac{dz}{dx}$ for $z = 3\left(\frac{1}{2}\right)^x - \frac{\sqrt{x}}{5}$

B. $\frac{d^2x}{dt^2}$ for $x(t) = -5(\ln 2)^t$

C. $f'(x)$ for $f(x) = \pi^x - x^\pi + e^\pi$

2. An initial population of rabbits was 9.5 thousand in 2006. Write a formula for the population of rabbits as a function of time since 2006 under each of the following models. Determine how fast the population was growing in 2009 in each case.

A. The population increased by 500 rabbits each year.
B. The population increased by 0.8% per year.

3. Find the x-intercept of the equation of the tangent line to $y = \left(\frac{1}{2}\right)^x + x^2$ at $x = 0$.

PRODUCT AND QUOTIENT RULES (3.3)

1. Find all values of t so that $f(t) = e^t(t^3 - 4)$ has a horizontal tangent.

2. Revenue can be expressed as price per item times number of items where number of items is a function of price. $R(p) = pq = p \cdot f(p)$. Suppose we sell a watch for \$60, $f(60) = 500$, and $f'(60) = -8$.

A. Give practical interpretations for $f(60) = 500$ and $f'(60) = -8$.
B. Find values and give practical interpretations for $R(60)$ and $R'(60)$.

3. Find the first derivative for each and simplify your answers.

A. $f(x) = \dfrac{ax^5 + 1}{ax^5 - 1}$ B. $h(t) = \dfrac{\sqrt[3]{t}}{1 + 4t^3}$ C. $p(z) = \left(\dfrac{z+4}{z-3}\right)5^z$

D. $g(t) = \begin{cases} te^t & t \le 0 \\ \dfrac{t}{t^2 - 1} & t > 0 \end{cases}$

4. Suppose f, g, and h are differentiable functions. Use the table of values to find the following.

x	$f(x)$	$g(x)$	$f'(x)$	$g'(x)$
2	3	4	-1	5
3	-1	-2	4	2

A. $\left.\dfrac{dy}{dx}\right|_{x=2}$ for $y = 3f(x)g(x)$.

B. Determine if $y = \dfrac{g(x)}{f(x)}$ is increasing or decreasing at $x = 3$.

5. Suppose $f(v)$ is liters/km used and $h(v)$ is liters/hr used when traveling v km/hr. $h(80) = 0.4$ and $h'(80) = 0.09$. Find values of and give practical interpretations for $f(80)$ and $f'(80)$.